



Phillips 66 Company Billings Refinery
Final Environmental Assessment for the
Permit modification: Hazardous Waste Permit #MTHWP-18-01

Hazardous Waste Program
Waste and Underground Tank Management Bureau

SITE NAME: Phillips 66 Company Billings Refinery		
PERMIT NUMBER: Hazardous Waste Permit #MTHWP-18-01		
LOCATION: Northwest ¼ of Section 2, Township 1 South, Range 26 East COUNTY: Yellowstone		
PROPERTY OWNERSHIP:	FEDERAL ____ STATE ____ PRIVATE <u>X</u> __	
EA PREPARER:	Denise A. Kirkpatrick	
Draft EA Date: 07/29/2022	EA Final Date: 09/30/2022	Permit Final Date: 09/30/2022

COMPLIANCE WITH THE MONTANA ENVIRONMENTAL POLICY ACT

The Montana Department of Environmental Quality (DEQ) prepared this Environmental Assessment (EA) in accordance with requirements of the Montana Environmental Policy Act (MEPA). An EA functions to determine the need to prepare an environmental impact statement (EIS) through an initial evaluation and determination of the significance of impacts associated with the proposed action. However, an agency is required to prepare an EA whenever statutory requirements do not allow sufficient time for the agency to prepare an EIS. This document may disclose impacts over which DEQ has no regulatory authority.

The Proposed Action of modifying Phillips 66 Company Billings Refinery's hazardous waste permit is considered a state action, that may have an impact on human health and the environment. Therefore, DEQ must prepare an environmental assessment.

This final EA analyzes the Proposed Action and No Action alternatives. Potential impacts that may result from the Proposed Action and No Action alternatives are discussed. DEQ will determine the need for additional environmental review based on consideration of MEPA criteria set forth in Administrative Rules of Montana (ARM) 17.4.608.

COMPLIANCE WITH THE MONTANA HAZARDOUS WASTE ACT

The Montana Hazardous Waste Act (MHWa) is the Montana equivalent of Subtitle C of the federal Resource Conservation and Recovery Act (RCRA). MHWa and RCRA Subtitle C govern proper management and disposal of hazardous waste, including permitting requirements for certain treatment, storage, and disposal activities. In addition, these laws govern requirements for facility-wide investigation and remediation of releases of hazardous waste or constituents at permitted facilities.

Regulations for hazardous waste management are found in the federal Code of Federal Regulations (CFR) Title 40, parts 260 through 273 and in the ARM 17.53.101 through 17.53.1502. The hazardous waste provisions in the CFR are incorporated by reference in the ARM. Montana hazardous waste permits are issued under the authority of the MHWa, Montana Code Annotated (MCA), Title 75, Chapter 10, Part 4 and according to the ARM Title 17, Chapter 53.

The MHWa, under § 75-10-406, MCA, requires Phillips 66 Company Billings Refinery (Phillips 66) to have a hazardous waste permit to provide post-closure care of its regulated unit. Section 75-10-406(7), MCA, states DEQ must require corrective action for all releases of hazardous waste or constituents at a facility permitted under § 75-10-406, MCA. This includes corrective action for releases that extend beyond the facility boundaries.

This Final EA was prepared in accordance with the requirements of 40 CFR 124.8, as incorporated by reference in the ARM 17.53.1201. For ease of reading this document, when federal regulations under Title 40 of the CFR have been incorporated by reference into the ARM, only the federal citation is used.

PUBLIC COMMENT ON THE ENVIRONMENTAL ASSESSMENT

The public was given the opportunity to comment on the draft EA. No comments were received on the draft EA. DEQ received general comments on the proposed remedy and completed a Response to Comments in accordance with 40 CFR 124.17 (incorporated by reference in ARM 17.53.1201).

DEQ has decided to issue a modification to Phillips 66's hazardous waste permit. A permit modification is necessary for DEQ to select a remedy for certain areas of the refinery. The permit modification will require remedy implementation. The decision is dated September 30, 2022.

An appeal of DEQ's decision must be submitted to the Montana Board of Environmental Review by October 31, 2022 (75-10-406(4), MCA). The final permit decision shall become effective on November 1, 2022, unless appealed.

SUMMARY OF THE PROPOSED ACTION

DEQ is proposing a permit modification to incorporate a remedy proposed by Phillips 66. The remedy incorporates technologies to cleanup soil and groundwater contamination. The table below provides a summary of the proposed remedy.

Summary of Proposed Action	
General Overview	<p>Phillips 66 is an operating petroleum refinery that began operation in 1949. The refinery is located on the southeast side of Billings, Montana and covers approximately 200 acres. See Figure 1. Site Location.</p> <p>A permit modification is necessary for DEQ to select a remedy for certain areas of the refinery that were not included in a 2002 remedy. In 2002, DEQ approved a site-wide soil and groundwater cleanup remedy for the refinery and incorporated the remedy into the hazardous waste permit. The new remedy would include additional areas of contamination at the refinery are called Solid Waste Management Units (SWMUs) and Areas of Concern (AOC). Table 1 list all the Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) at the refinery and their corrective action status. Figure 2 shows their location at the refinery.</p> <p>The permit modification is also needed for a proposed remedy change to site-wide groundwater boundary control. The proposal changes the boundary control remedy from a groundwater interceptor system (GWIS) to sparging technologies. Sparging technologies involves injecting air and/or ozone-peroxide into the contaminated aquifer to reduce concentrations of volatile constituents absorbed to soils and dissolved in groundwater.</p> <p>Phillips 66 proposed the change in the <i>2021 Outstanding SWMU/AOC Corrective Measures Study Report</i> dated November 8, 2021. The proposed remedy is grouped by exposure controls, boundary controls, and source controls.</p> <p>Exposure Controls</p> <p>Exposure control methods and technologies are intended to prevent unacceptable exposure to human health and the environment by managing potential exposure pathways. Exposure control technologies include</p>

	<p>engineering controls, institutional controls, and management plans. The proposed exposure controls would:</p> <ul style="list-style-type: none"> • Maintain environmental staff for project management and coordination. • Maintain engineering controls to control exposure from contaminants and protect human health (i.e., fencing, security, soil cover, personal protective equipment). • Maintain management plans (i.e., prohibit underground storage tanks, conduct above ground storage tank inspections, utilize pipeline and sewer inspections, conduct turnarounds, continue soil/waste management programs). • Continue employee specific training programs, including but not limited to: Refinery Annual Site-specific Trainings, Hazardous Waste Operations Training, Emergency Response and Pollution Prevention Training. • Continue to implement institutional controls that address potential exposure pathways related to contaminated groundwater and soil as well as restrict future land use to industrial use. <p>Boundary Controls</p> <p>Boundary control technologies prevent migration of constituents of interest (COIs) off refinery property. These controls may not have a significant effect on concentrations of COIs in source areas. As part of the boundary control portion of the remedy, Phillips 66 would:</p> <ul style="list-style-type: none"> • Discontinue the use of the groundwater interceptor system (GWIS) for hydraulic control. GWIS wells and associated piping and appurtenances may be completely decommissioned, abandoned, and removed by Phillips 66. The GWIS will be replaced by sparging systems. • Operate sparging systems along the Refinery's eastern and northern boundaries: the East Fence Line (EFL) Biosparge, North Fence Line (NFL) Biosparge, and EFL Oxygen-Peroxide (O-P) Sparge Systems. The Southeast Ozone-Peroxide Sparge System will be installed in 2022. Existing air sparging systems may be modified and new systems added as needed to maintain boundary control and target specific COIs. • Continue to monitor the effectiveness of in-situ bioremediation of groundwater.
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	<ul style="list-style-type: none"> Continue groundwater monitoring including compliance monitoring, performance monitoring, and plume monitoring. <p>Source Controls</p> <p>Source controls are intended to reduce or eliminate the source of COI to prevent further migration of contaminants in groundwater. Under the source control portion of the remedy, Phillips 66 would:</p> <ul style="list-style-type: none"> Continue operation of the 2nd Street Biosparge System to reduce COI mass in the groundwater affected by the reformat release near Tank 21. Continue product removal activities at any well containing measurable non-aqueous phase liquid (NAPL). Wells would be added or removed from the recovery list based on ongoing product recovery data. Removal methods may vary as conditions warrant. Continue to investigate and repair oily water process sewers. Continue to optimize remedy effectiveness by using supplemental remedial technologies to reduce source mass in the Reformat Release Area, South 40 Dense Nonaqueous Phase Liquide (DNAPL) Area, areas of the south-central portions of the refinery, and the vinyl chloride plume. The need for supplemental technologies will be based on the success of approved source and boundary control technologies. Supplemental technologies may include, but are not limited to, soil excavation, air sparging and soil vapor extraction, soil amendment injections, and thermal conductive heating. <p>Table 2 summarizes the proposed remedy. The table includes all SWMUs/AOCs and notes SWMUs/AOCs that will be impacted by the change from GWIS to sparging technologies.</p>
Proposed Action Estimated Disturbance	
Disturbance	The physical area that may be disturbed by corrective action includes the active refinery and other adjacent properties owned by Phillips 66 Company and Conoco Phillips Pipeline Company.
Proposed Action	
Duration	Construction: Substantial installation of corrective measures, including groundwater monitoring wells and sparge systems, was completed under interim measures. Any additional corrective action construction is anticipated to occur in 2023, after approval of the proposed remedy and Corrective Measures Implementation Work Plan.

	Construction Period/Operation Life: DEQ anticipates the remedy to continue throughout the remaining operational life of the refinery because ongoing industrial activities prevent access to all contamination.
Construction Equipment	Drilling rigs, backhoes, passenger vehicles, delivery trucks, cement trucks, various other types of smaller equipment
Personnel Onsite	Construction: Approximately 3 contract personnel Operations: No additional staff is anticipated.
Location and Analysis Area	Location: Phillips 66 Billings Refinery Analysis Area: The area being analyzed as part of this environmental review includes the refinery and adjacent property to the northeast and east of the site that has been impacted by the migration of contaminated groundwater originating from the refinery. See attached Figures 1 – 5 that show the site's location and contamination information.
Conditions incorporated into the Proposed Action	Module II of the hazardous waste permit includes conditions regulating the proposed remedy.

PURPOSE AND BENEFIT FOR PROPOSED ACTION

DEQ's purpose in conducting this environmental review is to evaluate the impacts of approving the remedy proposed by Phillips 66. The proposed remedy is described in *Outstanding SWMU/AOC Corrective Measures Study Report* dated November 8, 2021. DEQ's actions to initiate a permit modification are governed by the Montana Hazardous Waste Act (MHWA) and the Administrative Rules of Montana (ARM).

The benefits of DEQ's proposed action are implementation of corrective action for areas of the facility that do not have a remedy selected. Remedy implementation would improve groundwater quality.

ADDITIONAL ALTERNATIVE CONSIDERED

No Action Alternative: In addition to the proposed action, DEQ is considering a "no action" alternative. The no action alternative forms the baseline from which the impacts of the proposed action can be measured.

The "no action" alternative would deny the proposed remedy. Currently approved remedial actions would continue, including sparging and product recovery approved under interim measures. Groundwater monitoring would also continue to occur.

DEQ would not select a final remedy for clean-up at the South 40 DNAPL Area, Butane Release Area, Glacier Manifold Pipeline Release, and Jupiter Sulfur Expansion. Interim measures currently in place would continue. The SWMUs/AOCs would not be included in the facility-wide Corrective Measures Implementation (CMI) Work Plan. The permit requires Phillips 66 to submit the CMI Work Plan after approval of the proposed remedy.

Phillips 66 has submitted a complete Corrective Measures Study Report. The remedy proposed in the report is the basis for DEQ's remedy selection and permit modification.

If the applicant demonstrates compliance with all applicable rules and regulations as required for approval, the "no action" alternative would not be appropriate. Pursuant to, § 75-1-201(4)(a), MCA,

DEQ “may not withhold, deny, or impose conditions on any permit or other authority to act based on” an environmental assessment.

REGULATORY RESPONSIBILITIES

In accordance with ARM 17.4.609(3)(c), DEQ must list any federal, state, or local authorities that have concurrent or additional jurisdiction or environmental review responsibilities for the proposed action and the permits, licenses, and other authorizations required. The Hazardous Waste Program’s selection of a remedy does not impact any other authorities.

Phillips 66 must comply with laws and regulations of any federal, state, or local entity that may have authority over the facility. These entities may include, but not be limited to, DEQ Water Protection Bureau (groundwater and surface water discharge and stormwater permits) and DEQ Air Quality Bureau (air quality permit).

EVALUATION AND SUMMARY OF POTENTIAL IMPACTS TO THE PHYSICAL AND HUMAN ENVIRONMENT IN THE AREA AFFECTED BY THE PROPOSED PROJECT

The impacted analysis will identify and evaluate direct and secondary impacts.

- **Direct** impacts are those that occur at the same time and place as the action that trigger the effects.
- **Secondary** impacts mean “a further impact to the human environment that may be stimulated or induced by or otherwise result from a direct impact of the action.” ARM 17.4.603(18).

When impacts are expected to occur, the impacts analysis estimates the duration and intensity of the impact.

The duration of an impact is qualified as follows:

- **Short-term** impacts are defined as those impacts that would not last longer than the proposed operation of the site.
- **Long-term** impacts are defined as impacts that would remain or occur following shutdown of the proposed facility.

The severity of an impact is measured using the following:

- **No impact:** There would be no change from current conditions.
- **Negligible:** An adverse or beneficial effect would occur but would be at the lowest levels of detection.
- **Minor:** The effect would be noticeable but would be relatively small and would not affect the function or integrity of resources.
- **Moderate:** The effect would be easily identifiable and would change the function or integrity of the resources.
- **Major:** The effect would alter the resources.

1. TOPOGRAPHY, GEOLOGY AND SOIL QUALITY, STABILITY AND MOISTURE

The area being analyzed (as part of this environmental review) includes the refinery and adjacent property, including land northeast and east of the site that have groundwater impacts from the refinery.

The surface at the refinery is a mix of concrete, asphalt, gravel-based fill, and soil cover. The following describes the surface cover at the four SWMUs/AOCs that are part of the Proposed Action and were not included in previous remedy selections

- South 40 DNAPL Area - Surface area is covered by clean, gravel-based fill. Constituents of interest (COIs) are limited to subsurface soils, groundwater, and non-aqueous phase liquid (NAPL).
- Butane Release Area - Surface areas are covered by concrete, asphalt, buildings, and clean gravel-based fill. COIs are limited to subsurface soils, groundwater, and NAPL.
- Glacier Manifold Pipeline Release Area - Surface-expressed contaminants were previously excavated. Surface areas are covered by clean, gravel-based fill. COIs are limited to subsurface soil, groundwater, and NAPL.
- Jupiter Sulphur Expansion - Surface-expressed contaminants were excavated during construction activities. Surface areas are covered by clean, gravel-based fill. COIs are limited to subsurface soils and groundwater.

Leaching of COIs from subsurface soil to groundwater is being monitored by the refinery's groundwater monitoring network. Phillips 66 requires HAZWOPER-trained personnel perform subsurface work at or within known SWMUs/AOCs and areas where contamination is suspected through an on-site administrative permitting process. This activity is intended to mitigate human health risks.

Direct Impacts:

Proposed Action: The proposed remedial activities include recovery of hydrocarbon and sparging of contaminated groundwater. The implementation of the proposed remedy would have minor positive impacts on soil quality.

No Action: For the outstanding SWMUs and/or AOCs in the Proposed Action, DEQ has required interim measures to address hydrocarbon contamination and dissolved phase contamination especially at the site's boundary. This work would continue even if the Proposed Action was not approved. The No Action alternative would have no impacts.

Secondary Impacts: Secondary impacts are those occurring at a later time or distance from the triggering action. Improvements to soil quality by removing contamination would reduce the source of contamination to groundwater. Minor secondary impacts to groundwater are anticipated.

No Action: No impacts are anticipated.

2. WATER QUALITY, QUANTITY, AND DISTRIBUTION

The refinery is situated on an alluvial terrace deposit associated with the Yellowstone River. The river is approximately 1,000 feet east of the refinery. The geology underlying the site is clay-silts from ground surface to about 6 feet below ground surface, sandy-gravels from 6 to 22 feet below ground surface, and gray shale bedrock (Colorado Shale) at approximately 22 feet below ground surface. The bedrock contact at the refinery varies between 17 to 25 feet below ground surface.

The Colorado Shale acts as an aquitard. An aquitard limits the downward flow of water. Groundwater flows northeast towards the Yellowstone River.

Historical activities have resulted in releases to soil and groundwater of hazardous waste and materials that contained hazardous constituents. The main hazardous constituents of interest (COIs) in groundwater and soil at the refinery are benzene, toluene, ethylbenzene, xylenes, and vinyl chloride.

Groundwater contamination is monitored by a site-wide groundwater monitoring network. The groundwater monitoring strategy includes:

- Fluid level gauging
- Compliance point monitoring
- Groundwater plume monitoring
- Corrective action performance monitoring

Wells are gauged and sampled as dictated by the approved Corrective Measures Implementation (CMI) Work Plan or Interim Measures (IM) Work Plan. In the third quarter of 2021, fluid level gauging was completed at 242 wells. Groundwater samples were collected from 140 monitoring locations. Eleven monitoring wells had measurable or observed LNAPL or DNAPL during the third quarter of 2021. Measured LNAPL thickness ranges from a sheen to about 3 feet. See Figure 3.

COIs in groundwater are tracked and evaluated after each sampling event. Corrective action has been occurring at the refinery for several decades. Previously approved remedial work, including sparging technologies under interim measures, have shown success at reducing the extent and magnitude of groundwater contamination. Figures 4 show changes in BTEX from 2014 to 2021.

Boundary monitoring wells are used to evaluate whether COIs meet Montana groundwater quality standards. In the third quarter of 2021, vinyl chloride exceeded groundwater standards at two off-site monitoring locations. Arsenic was detected in two monitoring locations above groundwater standards.

Vinyl chloride in groundwater at the Phillips 66 refinery is generally caused by the breakdown of trichloroethene (TCE). Known sources for the vinyl chloride plume, at the southern portion of the refinery, include historical releases from the SOSP, South 40 DNAPL Area, and Area 3 Landfarm. Vinyl chloride does not degrade easily under anaerobic conditions. The sparge technologies, included in the Proposed Action, create more aerobic conditions in the subsurface that increase degradation of the vinyl chloride plume. Figure 5 shows changes in vinyl chloride concentrations from 2014 to 2021.

Arsenic is the primary inorganic COI at the refinery. Arsenic is found at the refinery from refinery contamination, natural occurring amounts in soil, and potentially from historical insecticide use. Dissolved arsenic mobilization due to shifting redox conditions resulting from microbial degradation of petroleum hydrocarbons is normal and expected. Widespread use of arsenic-based insecticides (the site's prior use was agricultural) may also be a component of elevated arsenic levels. Arsenic levels have been reduced by corrective action at the site, including sparging technologies.

Direct Impacts:

Proposed Action: The Proposed Action would have minor positive impacts to water quality, by reducing the level of contamination.

No Action: Sparging technologies approved under interim measures would continue. No impacts are anticipated.

Secondary Impacts:

Proposed Action: Improvements to onsite groundwater would result in improved groundwater quality off-site. Groundwater flows towards the Yellowstone River. Improving groundwater may have a negligible positive impact on the Yellowstone River.

No Action: This alternative is expected to have no impacts.

3. AIR QUALITY

The construction of wells and any removal of contaminated soil may could result in a slight short-term increase in fugitive emissions. DEQ has approved sparging at the refinery under interim measures. The Proposed Action incorporates the sparging technology into the final remedy. Optimization of the sparging systems may result in an increase or decrease in the number of wells and/or changes to the system's operations. No additional air quality permitting is anticipated related to the Proposed Action.

Direct Impacts:

Proposed Action: DEQ anticipates the Proposed Action may have minor impacts to air quality. However, the activities would occur over a limited time, and if done in compliance with air quality requirements to minimize any fugitive emissions, the impacts should be very minor.

No Action: No impacts are anticipated.

Secondary Impacts:

Proposed Action: The proposed remediation activities may have negligible impacts to air quality if additional sparging wells are installed later during any site optimization. The impacts would be negligible in comparison to other ongoing air quality emissions at the refinery.

No Action: No impacts are expected.

4. VEGETATION COVER, QUANTITY AND QUALITY

The area being analyzed includes the refinery and adjacent property impacted by off-site groundwater contamination. Commercial and industrial activities occur at the refinery and immediately adjacent property to the east. The activities at properties impacted by off-site groundwater contamination include a stockyard, railroad, interstate highway, and former power plant. Coulson Park is also located northeast of the refinery. Coulson Park is a City of Billings' park that occupies land between I-90 and the bank of the Yellowstone River. Coulson Park is not impacted by the off-site groundwater contamination.

Direct Impacts & Secondary Impacts:

Proposed Action: The proposed remedy would not impact vegetation within the analyzed area. The refinery and adjacent properties impacted by the off-site groundwater contamination do not have substantial vegetation cover due to the nature of the industrial activities on the properties.

No Action: No impacts are anticipated. Currently approved on-site corrective action activities and off-site well monitoring would continue. These activities do not impact vegetation cover, quantity, and quality.

5. TERRESTRIAL, AVIAN AND AQUATIC LIFE AND HABITATS

The proposed corrective actions would be occurring at an operating refinery and adjacent industrial properties. The corrective actions would not be substantially different from the activities already conducted at the site.

Direct Impacts:

Proposed Action: DEQ does not anticipate activities proposed in the permit modification would impact terrestrial life or habitats.

No Action: No impacts are anticipated.

Secondary Impacts:

Proposed Action: Reducing contamination of groundwater onsite will improve groundwater quality off-site. Groundwater flows in the direction of the Yellowstone River. No negative impacts to the river from the refinery's groundwater contamination have been documented. However, improved groundwater quality may have a negligible minor positive effect on terrestrial, avian and aquatic life and habitats in the Yellowstone River.

No Action: Currently approved corrective action would continue. No impacts are expected.

6. UNIQUE, ENDANGERED, FRAGILE OR LIMITED ENVIRONMENTAL RESOURCES

The proposed corrective actions would be occurring at an operating refinery and adjacent industrial properties. The corrective actions would not be substantially different from the activities already conducted at the site. No unique, endangered, fragile, or limited environmental resources have been identified at the refinery or adjacent industrial properties.

Direct Impacts:

Proposed Action: DEQ anticipates the Proposed Action would have no impact on unique, endangered, fragile, or limited environmental resources.

No Action: No impacts are anticipated.

Secondary Impacts:

Proposed Action: Reducing contamination of groundwater onsite would improve groundwater quality off-site. Groundwater flows in the direction of the Yellowstone River. Improving groundwater may have a negligible positive impact on the Yellowstone River. The proposed action would have negligible secondary impacts. The proposed actions are currently impacting land used for industrial operations and would not change the effect to the surface environment.

No Action: DEQ does not expect any impacts to environmental resources if the Proposed Action is not approved.

7. HISTORICAL AND ARCHAEOLOGICAL SITES

The area being analyzed includes the refinery and immediately adjacent properties to the northeast and east of the refinery (impacted by off-site groundwater contamination). Commercial and industrial activities occur at the refinery and immediately adjacent properties to the east. The proposed remedy would include wells and remedial activities on previously disturbed property at the refinery and adjacent industrial sites, including Jupiter Sulphur and Phillips Pipeline property.

Direct Impacts:

Proposed Action: No undisturbed property is proposed to be impacted by corrective action. The proposed action would occur on land that has current industrial activities. No impacts to historical and/or archeological sites are expected.

No Action: No impacts are expected.

Secondary Impacts:

Proposed Action: No secondary impacts are expected.

No Action: No impacts.

8. SAGE GROUSE EXECUTIVE ORDER

The refinery and adjacent properties are not located in core, general or connectivity sage grouse habitat, as designated by the Sage Grouse Habitat Conservation Program.

Direct Impacts & Secondary Impacts:

Proposed Action & No Action: No direct or secondary impacts would occur because the project is not located within sage grouse habitat.

9. AESTHETICS

The area being analyzed includes the refinery and adjacent property to the northeast and east of the refinery. The refinery and properties to the east of the site are heavy industry.

Direct Impacts:

Proposed Action: The proposed remedial activities include minor construction activities, such as well installation. The changes would not result in impacts to the appearance of the site.

No Action: No aesthetic changes would occur.

Secondary Impacts:

Proposed Action: No impacts are expected because construction activities are minor, and no deconstruction activities are proposed.

No Action: No impacts will occur.

10. DEMAND ON ENVIRONMENTAL RESOURCES OF LAND, WATER, AIR OR ENERGY

The area being analyzed includes the refinery and adjacent property, including land east of the site that have groundwater impacts from the refinery. Implementation of corrective measures would require energy for ongoing sparging, product recovery, and groundwater monitoring. This would include gasoline, diesel, and electricity to operate equipment.

Direct Impacts:

Proposed Action: The proposed remediation activities would have minor impacts on energy demand. DEQ does not anticipate any demand on land, water, or air resources.

No Action: No demand on environmental resources would occur beyond currently approved activities.

Secondary Impacts:

Proposed Action: The additional corrective action at the refinery would require energy to be produced. This additional energy demand would be negligible when weighed against existing energy consumption.

No Action: No demand on environmental resources is expected if the Proposed Action is not approved.

11. IMPACTS ON OTHER ENVIRONMENTAL RESOURCES

The area being analyzed includes the refinery and adjacent property, including land that has groundwater impacts from the refinery. The refinery is surrounded by properties zoned as commercial, industrial, and public-civic & institutional.

Direct Impacts:

Proposed Action: No other environmental resources have been identified in the analysis area beyond those discussed above. There are no impacts to other environmental resources.

No Action: No impacts to other environmental resources would occur.

Secondary Impacts:

Proposed Action & No Action: No secondary impacts to other environmental resources are anticipated.

12. HUMAN HEALTH AND SAFETY

The area being analyzed includes the refinery and adjacent property, including land that has groundwater impacts from the refinery. The proposed corrective measures include common remedial activities, such as construction and operation of new wells and sparging equipment. The proposed construction and operation activities are not unique and safety issues should be mitigated by using proper techniques and personal protective equipment. Phillips 66 and its contractors have safety and health plans.

Phillips 66 requires HAZWOPER-trained personnel perform sub-surface work at or within known SWMUs/AOCs and areas where contamination is suspected through an on-site administrative permitting process. This activity is intended to mitigate human health risks. However, some of the activities proposed in the remedy may expose workers to contaminated water or soil. The proposed remedy should over time decrease the amount of contamination at the site.

Direct Impacts:

Proposed Action: Overall, human health impacts should be minor during implementation of the proposed action and result in positive minor improvements to the human environment.

No Action: No impacts are anticipated.

Secondary Impacts:

Proposed Action & No Action: No secondary impacts are anticipated.

13. INDUSTRIAL, COMMERCIAL AND AGRICULTURAL ACTIVITIES AND PRODUCTION

Phillips 66 would hire construction companies and consultants to complete well installations, perform construction activities associated with remediation, prepare work plans and reports, and to conduct sampling. Samples for analytical evaluation would be to an external analytical laboratory for analysis.

Direct Impacts:

Proposed Action: Minor impacts to industrial and commercial activity are anticipated because additional work would be carried out to implement the proposed remedy. No impacts to refinery operations are anticipated.

No Action: No impacts are anticipated if the Proposed Action is not approved. Currently approved remediation work would continue.

Secondary Impacts:

Proposed Action & No Action: No secondary impacts are anticipated.

14. QUANTITY AND DISTRIBUTION OF EMPLOYMENT

Employees at the refinery include Phillips 66 employees and contractors. The proposed activities would involve the work of full-time Phillips 66 employees and contractors.

Direct Impacts:

Proposed Action: Any construction activities may result in a short-term increase in contractors; however, the impact is expected to be negligible when compared to the overall employment at the refinery.

No Action: If the Proposed Remedy is not approved minor negative impacts to contractor employment may occur. Additional contractors for remediation work and reporting regarding outstanding SWMUs and AOCs would not occur.

Secondary Impacts:

Proposed Action: No secondary impact is expected to long term employment from the proposed actions because the employees doing the current corrective action are expected continue to be employed.

No Action: No impacts to employment are expected.

15. LOCAL AND STATE TAX BASE AND TAX REVENUES

The proposed action does not result in an expansion of the areal extent of the refinery or the construction of new process equipment. No additional full-time employees are anticipated.

Direct Impacts & Secondary Impacts:

Proposed Action & No Action: No impacts to local and/or state tax base and revenue are expected.

16. DEMAND FOR GOVERNMENT SERVICES

The hazardous waste permit requires Phillips 66 submit work plans and reports including a Corrective Measures Implementation Work Plan and Report. DEQ personnel would be required to review these reports. DEQ would determine the facility's compliance with the permit and applicable laws and regulations.

Direct Impacts:

Proposed Action: Minor impacts to government services would occur because DEQ would be required to oversee the permit requirements. The federal Environmental Protection Agency would also review corrective action work plans and reports.

No Action: No change to governmental services would occur.

Secondary Impacts:

Proposed Action & No Action: No secondary impacts are anticipated.

17. LOCALLY ADOPTED ENVIRONMENTAL PLANS AND GOALS

The area being analyzed includes the refinery and adjacent property, including land to the northeast and east of the site that have groundwater impacts from the refinery. A review was conducted by DEQ on May 31, 2021 of the City of Billings Community & Neighborhood Plans ([Community & Neighborhood Plans | City of Billings, MT - Official Website](#)) and zoning [Billings Zoning \(arcgis.com\)](#).

Direct Impacts:

Proposed Action: The refinery is zoned heavy industry. Adjacent property is heavy industry, light industrial, heavy commercial, and public-civic and institutional. The proposed action would not impact zoning. No impact to published plans was noted upon review of relevant websites.

No Action: No impact to local plans or goals would occur.

Secondary Impacts:

Proposed Action & No Action: No secondary impacts to locally adopted environmental plans and goals are anticipated.

18. ACCESS TO AND QUALITY OF RECREATIONAL AND WILDERNESS ACTIVITIES

The area being analyzed includes the refinery and adjacent property, including land northeast and east of the refinery. The refinery and properties to the east of the site include heavy industry. Recreational opportunities exist at Coulson Park and the Yellowstone River. The river is located 1000 feet east of the refinery.

Direct Impacts:

Proposed Action: The proposed corrective action would impact the refinery property and land to the east zoned heavy industry. No corrective action construction or sampling is anticipated to impact Coulson Park or the Yellowstone River. No impacts to access to and quality of recreational and wilderness activities will occur.

No Action: There would be no impacts to recreational and wilderness activities.

Secondary Impacts:

Proposed Action & No Action: No secondary impacts are anticipated.

19. DENSITY AND DISTRIBUTION OF POPULATION AND HOUSING

The area being analyzed includes the refinery and adjacent property, including land east of the site that have groundwater impacts from the refinery. The refinery and properties to the east of the site include heavy industry.

Direct Impacts:

Proposed Action: The proposed action would not add to the population of Billings. No additional housing is anticipated. Therefore, no impacts are expected to the density and distribution of population and housing.

No Action: Failure to approve the proposed remedy would have no impacts on population and housing.

Secondary Impacts:

Proposed Action & No Action: No impacts are anticipated.

20. SOCIAL STRUCTURES AND MORES

The refinery has been in operation for many years and the activities proposed are not a substantial change in clean-up work.

Direct Impacts & Secondary Impacts:

Proposed Action & No Action: No impact is anticipated to social structures or mores of the community.

21. CULTURAL UNIQUENESS AND DIVERSITY

The area being analyzed includes the refinery and adjacent property to the east of the site that has been impacted by groundwater contamination. The refinery and properties to the east of the site include heavy industry. The refinery has been in operation for many years and the proposed changes are not substantially different from existing corrective action.

Direct Impacts & Secondary Impacts:

Proposed Action & No Action: No impact is anticipated to cultural uniqueness and diversity in the analysis area.

22. PRIVATE PROPERTY IMPACTS

The proposed project would take place on privately-owned land. The analysis done in response to the Private Property Assessment Act indicates no impact. A Private Property Assessment Act (PPAA) Checklist is available in the Hazardous Waste Program files.

23. OTHER APPROPRIATE SOCIAL AND ECONOMIC CIRCUMSTANCES

No additional direct or secondary impacts are anticipated from the proposed action.

CUMULATIVE IMPACTS

Cumulative impacts are the collective impacts on the human environment within the borders of the proposed action when considered in conjunction with other past and present actions (related to the proposed action by location and generic type). Related future actions must also be considered when these actions are under concurrent consideration by any state agency through preimpact statement studies, separate impact statement evaluation, or permit processing procedures.

This environmental review only analyzes the proposed action submitted by Phillips 66, which is DEQ's approval of the proposed remedy through a permit modification. Environmental impacts from other sources of pollution exist in the area surrounding the refinery. These include air emissions and upgradient groundwater contamination.

The proposed action should result in an overall improvement to soil and groundwater contamination. The time frame for obtaining groundwater standards has not been determined. The proposed corrective action would not impact upgradient groundwater contamination. Cumulative impacts to air quality from corrective action activities, including those previously approved and the proposed actions, would be negligible.

DEQ considered potential impacts related to this project and potential secondary impacts. Due to the limited activities in the analysis area, cumulative impacts related to this proposed action will be negligible.

PUBLIC INVOLVEMENT

Scoping for this proposed action consisted of internal efforts to identify substantive issues and/or concerns related to the proposed operation. Internal efforts include queries to the following websites/databases/personnel:

- Montana Cadastral Mapping Program
- City of Billings

The public was invited to comment on the modified permit conditions and/or the draft environmental assessment. The modified permit conditions incorporate the proposed remedy in Appendix A of Module II. Appendix A includes a remedy selection document called a Statement of Basis. The comment period ran from July 29, 2022 to September 13, 2022.

DEQ received general comments on the proposed remedy, but no comments were received on the draft EA. DEQ has completed a Response to Comments in accordance with 40 Code of Federal Regulations (CFR) 124.17 (incorporated by reference in Administrative Rules of Montana (ARM) 17.53.1201).

The final Module II of the hazardous waste permit (including the Statement of Basis), the final environmental assessment, and Response to Comments are on DEQ's website at:

<https://deq.mt.gov/public/publiccomment> and at the following location:

Location	Review Hours
Montana Department of Environmental Quality Helena Office Waste and Underground Tank Management Bureau Metcalf Building 1520 E. 6th Avenue Helena, Montana 406-444-5300	Monday through Friday 8:00 am – 5:00 pm

DEQ has decided to issue a modification to Phillips 66's hazardous waste permit. A permit modification is necessary for DEQ to select a remedy for certain areas of the refinery. The permit modification will require remedy implementation. The decision is dated September 30, 2022.

An appeal of DEQ's decision must be submitted to the Montana Board of Environmental Review by October 31, 2022 (Montana Code Annotated 75-10-406(4)). The final permit decision shall become effective on November 1, 2022, unless appealed.

OTHER GOVERNMENTAL AGENCIES WITH JURISDICTION

The proposed project would be fully located on privately-owned land. All applicable local, state, and federal rules must be adhered to, which, at some level, may also include other local, state, federal, or tribal agency jurisdiction.

NEED FOR FURTHER ANALYSIS AND SIGNIFICANCE OF POTENTIAL IMPACTS

Under ARM 17.4.608, DEQ is required to determine the significance of impacts associated with the proposed action. This determination is the basis for the agency's decision concerning the need to prepare an environmental impact statement and references DEQ's evaluation of individual and cumulative impacts. DEQ is required to consider the following criteria in determining the significance of each impact on the quality of the human environment:

1. The severity, duration, geographic extent, and frequency of the occurrence of the impact;

"Severity" is analyzed as the density of the potential impact while "extent" is described as the area where the impact is likely to occur. An example could be that a project may propagate ten noxious weeds on a surface area of 1 square foot. In this case, the impact may be a high severity over a low extent. If those ten noxious weeds were located over ten acres there may be a low severity over a larger extent.

"Duration" is analyzed as the time period in which the impact may occur while "frequency" is analyzed as how often the impact may occur. For example, an operation that occurs throughout the night may have impacts associated with lighting that occur every night (frequency) over the course of the one season project (duration).
2. The probability that the impact will occur if the proposed action occurs; or conversely, reasonable assurance in keeping with the potential severity of an impact that the impact will not occur;
3. Growth-inducing or growth-inhibiting aspects of the impact, including the relationship or contribution of the impact to cumulative impacts;
4. The quantity and quality of each environmental resource or value that would be affected, including the uniqueness and fragility of those resources and values;
5. The importance to the state and to society of each environmental resource or value that would be affected;
6. Any precedent that would be set because of an impact of the proposed action that would commit DEQ to future actions with significant impacts or a decision in principle about such future actions; and

7. Potential conflict with local, state, or federal laws, requirements, or formal plans.

The significance determination is made by giving weight to these criteria in their totality. For example, impacts with moderate or major severity may be determined to be not significant if the duration of the impacts is short-term. As another example, however, moderate or major impacts of short-term duration may be significant if the quantity and quality of the resource is limited and/or the resource is considered to be unique or fragile. As a final example, moderate or major impacts to a resource may be determined to be not significant if the quantity of that resource is high or the quality of the resource is not unique or fragile.

Pursuant to ARM 17.4.607, preparation of an environmental assessment is the appropriate level of environmental review under MEPA if statutory requirements do not allow sufficient time for an agency to prepare an environmental impact statement. An agency determines whether sufficient time is available to prepare an environmental impact statement by comparing statutory requirements that establish when the agency must make its decision on the proposed action with the time required to obtain public review of an environmental impact statement plus a reasonable period to prepare a draft environmental review and, if required, a final environmental impact statement.

SIGNIFICANCE DETERMINATION

The severity, duration, geographic extent, and frequency of the occurrence of the primary, secondary, and cumulative impacts associated with the Proposed Action will be limited. DEQ has not identified any significant impacts associated with the Proposed Action for any environmental resource. Approving the proposed remedy through a permit modification will not set a precedent that commits DEQ to future actions with significant impacts or decision in principle about such future actions.

DEQ's issuance of the permit modification for the remedy selection does not set a precedent for DEQ's review of other proposed remedies or permit applications. A decision of the appropriate level of environmental review is made based on case-specific considerations of the criteria, set forth in ARM 17.4.608.

The proposed action does not have any growth-inducing or growth-inhibiting aspect. The proposed action does not conflict with any local, state, or federal laws, requirements, or formal plans. Based on a consideration of the criteria set forth in ARM 17.4.608, the proposed state action is not predicted to significantly impact the quality of the human environment. Therefore, preparation of an EA is determined to be the appropriate level of environmental review under the Montana Environmental Policy Act (MEPA).

ENVIRONMENTAL ASSESSMENT AND SIGNIFICANCE DETERMINATION PREPARED BY:

Denise A. Kirkpatrick
Hazardous Waste Specialist

REFERENCES

[Coulson Park - Billings Parks and Recreation](#)

[Community & Neighborhood Plans | City of Billings, MT - Official Website](#)

[Billings Zoning \(arcgis.com\)](#)

2021 Outstanding SWMU/AOC Corrective Measures Study Report dated November 8, 2021

Facility-Wide Groundwater Monitoring and Corrective Action Progress Report (CMI #216), Second Quarter 2021 dated July 27, 2021

Facility-Wide Groundwater Monitoring and Corrective Action Progress Report (CMI #217), Third Quarter 2021 dated October 28, 2021

Table 1. Corrective Action Status of Solid Waste Management Units and Areas of Concern

Name of Solid Waste Management Unit (SWMU)/Area of Concern (AOC)	Included in EPA Consent Order	RFI Status	CMS Status	Statement of Basis Date	CMI Status
API Separator	Yes	C	NR	NR	NR
Area 1 Landfill	Yes	C	C	2002	IP
Area 2 Alky Landfill	Yes	C	NR	NR	NR
Area 3 Landfarm	Yes	C	C	2002	C
Area 4 Landfarm	Yes	C	NR	NR	NR
Boiler House Blowdown Pond	Yes	C	C	2002	IP
Butane Release Area	No	C	C	2022	R
COI in Ground Water	No	C	C	2002 & 2022	IP
COI in Soil	No	C	C	2002 & 2022	IP
Former Flare Pit Impoundment	Yes	C	C	2002	IP
Glacier Manifold Pipeline Release	No	C	C	2022	R
Jupiter Sulfur Expansion	No	C	C	2022	R
Northeast Pit Area	Yes	C	C	2002	IP
Northwest Area 3 Landfarm	No	C	NR	NR	NR
Oily Water Process Sewer System	Yes	C	C	2002	IP
Process Area Diversion Pond	Yes	C	C	2002	IP
Product on Ground Water	No	C	C	2002 & 2022	IP
South 40 DNAPL	No	C	C	2022	R
South Oily Sludge Pits	Yes	C	C	2006	C
Tank 80	No	NR	NR	NR	NR
Tank Farm Area	No	C	C	2002	IP
Trenches Area of Concern	No	C	C	2002	IP
Truck and Tank Car Loading Area	Yes	C	C	2002	IP

Complete (C)

In Progress (IP)

Corrective Measures Study (CMS)

Not Required (NR)

RCRA Facility Investigation (RFI)

Corrective Measures Implementation (CMI)

Required (R)

Table 2. 2022 Proposed Remedy - Phillips 66 Company Billings Refinery

SWMU/AOC	Description	Current Status	2020 CMS Evaluation	2022 Corrective Measures
2020 Study Area				
South 40 DNAPL	DNAPL discovered in process of investigating SWMUs in southern portion of the Refinery.	IMs - Ongoing. Located within site-wide groundwater monitoring program. Pilot testing of in-situ chemical oxidation technologies concluded in December 2021.	CVOC concentration trends indicate the primary source of the VC plume is TCE in the vicinity of the Area 3 Landfarm, SOS, and South 40 DNAPL Area. Excavation of SOSP soils has decreased CVOC source mass and decreased concentrations in the VC plume.	<p>Sparge systems will be operated to mitigate off-site migration of COIs in groundwater.</p> <p>Product removal will be conducted in wells with measurable NAPL to the extent practical.</p> <p>Monitoring will be conducted to evaluate permit compliance, corrective action performance, monitored natural attenuation (MNA), and plume characteristics.</p> <p>Source reduction technologies may be employed to the extent practical.</p>
Butane Release Area	Leak in Glacier Butane Delivery Pipeline. Butane release to soil.	IMs - Ongoing. Located within site-wide groundwater monitoring program	Performance monitoring for the East Fence Line Biosparge System indicates COIs are controlled downgradient of the AOC.	
Glacier Manifold Pipeline Release	Area beneath the Glacier Pipeline crude oil manifold. Soil impacts from release.	IMs – Ongoing product recovery. Located within the site-wide monitoring program.	No change	
Jupiter Sulphur Expansion	Contaminated soils northeast of the Area 3 Landfarm discovered during construction of the Jupiter Sulphur plant expansion in 2015.	Located within site-wide groundwater monitoring program.	Analytical results presented in 2017 RFI indicate the SWMU is not a significant source of COIs leaching to groundwater from soils.	
Reformate Release Area (Within existing AOCs: Tank Farm Area, COI in Groundwater, and COI in Soil)	Release from buried reformate transfer line near Tank 21 discovered in 2012.	IMs - Ongoing. 2nd Street Biosparge installed as a plume control measure. Remedial assessment is ongoing. Located within site-wide groundwater monitoring program.	Data from routine groundwater monitoring events indicate the Reformate Release Area is a source of BTEX constituents in soil and groundwater.	
COI in Groundwater – (Includes the Vinyl Chloride Plume)	Dissolved-phase VC in the southern portion of the Refinery.	Dissolved-phase VC at the refinery is attributed to historical operations, specifically SWMUs and AOCs near the southern portion of the refinery	CVOC concentration trends indicate the primary source of the VC plume is TCE in the vicinity of the Area 3 Landfarm, SOSP, and South 40 DNAPL Area.	

SWMU/AOC	Description	Current Status	2020 CMS Evaluation	2022 Corrective Measures
South 40 Area				
Area 3 Landfarm	Operated from 1970 - 1972 as a landfarm for petroleum refining waste. Soil includes contamination with CVOCs.	No further action (NFA) determination for soils. SWMU downgraded to low-priority. Located within the site-wide groundwater monitoring program.	CVOC concentration trends indicate the primary source of the VC plume is TCE in the vicinity of the Area 3 Landfarm, SOSP, and South 40 DNAPL Area. Excavation of SOSP soils has decreased CVOC source mass and decreased concentrations in the VC plume.	Sparge systems will be operated to prevent off-site migration of groundwater and COIs. Product removal will be conducted in wells with measurable LNAPL, if needed, to the extent practical. Monitoring will be conducted to evaluate MNA and plume characteristics. Corrective measures taken to address the VCPlume may also affect this unit.
Area 4 Landfill	Used for disposal of discarded valves, piping, broken concrete, and spent FCC catalyst. Soil contamination includes VOCs, SVOCs, and metals.	NFA for soils. Located within the site-wide groundwater monitoring program.	No change	Sparge systems will be operated to prevent off-site migration of COIs contaminated groundwater. Monitoring will be conducted to evaluate MNA and plume characteristics.
South Oily Sludge Pit (SOSP)	Former temporary storage area for API separator sludge and other refinery waste. Vadose zone soils were excavated and disposed.	NFA for soils (vadose zone soils excavated). Located within the site-wide groundwater monitoring program.	CVOC concentration trends indicate the primary source of the VC plume is TCE in the vicinity of the Area 3 Landfarm, SOSP, and South 40 DNAPL Area. Excavation of SOSP soils has decreased CVOC source mass and decreased concentrations in the VC plume.	
Northwest Area 3 Landfarm	Former FCC catalyst and landfarm material in soils.	NFA for soils. Located within the site-wide groundwater monitoring program.	No change	

SWMU/AOC	Description	Current Status	2020 CMS Evaluation	2022 Corrective Measures
Wastewater Treatment Units/Flare Units				
Former API Separator	Wastewater treatment unit. Upgradient sources of COI and LNAPL may have affected groundwater beneath the API.	NFA, CMI Not Required - Located within the site-wide groundwater monitoring program.	No change	Sparge systems will be operated to prevent off-site migration of groundwater and COIs. Monitoring will be conducted to evaluate MNA and plume characteristics.
Area 1 Landfill	The SWMU is capped by the asphalt floor beneath the Emergency Holding Pond. While the refinery continues to operate, contaminated soils are not accessible.	CMI - Ongoing. Located within the site-wide groundwater monitoring program.		
Area 2 Alky Landfill	Used for disposal of equipment associated with alkylation unit. Soil with VOCs, SVOCs, and metals; groundwater inconclusive due to upgradient sources of COIs and LNAPL.	CMI - Ongoing. Located within the site-wide groundwater monitoring program.		
Boiler House Blowdown Pond/No. 3 Bio-Pond	Demineralizer regeneration of wastes and steam generation of blowdown waters handled in this unit. No longer in service; filled with soil. Possible impact to groundwater via leachable soils.	NFA. Located within the site-wide groundwater monitoring program.		
Former Flare Pit Impoundment	Located on 1957 aerial photograph; no records of wastes managed on this area. Potential soil with leachable VOCs.	CMI - Ongoing. Located within the site-wide groundwater monitoring program.		
Process Area Diversion Pond	Partially in-ground concrete basin with two bays; pond has contained overflow from the oil process wastewater that exceeded capacity of API separator.	NFA for soils. Located within the site-wide groundwater monitoring program.		

SWMU/AOC	Description	Current Status	2020 CMS Evaluation	2022 Corrective Measures
Processing/Tank Farm				
Northeast Pit Area	Identified in 1950 aerial photograph: no records for waste managed on this area. Soil with leachable organic COI.	CMI - Ongoing. Located within the site-wide groundwater monitoring program	No change	Sparge systems will be operated to prevent off-site migration of groundwater and COIs. Monitoring will be conducted to evaluate MNA.
Oily Water Process Sewer System	Refinery-wide oily water process sewer system.	CMI - Ongoing. Inspection/repair/replacement as accessed. Located within the site-wide groundwater monitoring program.	No change	Continue ongoing repair/replacement as accessed.
Tank Farm Area	Tank farm area on refinery. Soil with leachable organic COI.	CMI - Ongoing. Located within site-wide groundwater monitoring program.	Reformat Release Area included in 2020 Study Area located above. AOC boundary corrected	Sparge systems will be operated to prevent off-site migration of COIs. Monitoring will be conducted to evaluate MNA and plume characteristics.
Tank 80	Soil with leachable inorganic COI.	RFI - Not Required; CMS - Not Required; CMI - Not Required	No change	
Trenches Area of Concern	Two trenches containing dark liquid; no records for wastes managed on this area. Soil with leachable organic COI.	CMI - Ongoing. Located within site-wide groundwater monitoring program.	No change	
Truck and Tank Car Loading Area	Loading area used for management and distribution of petroleum products. Diesel release to soil.	NFA for soils. Area is located within site-wide groundwater monitoring program.	No change	Product removal will be conducted in wells with measurable NAPL to the extent practical.
Refinery Wide				
COI in Groundwater	Site-wide groundwater contaminated with COI.	CMI – Ongoing	Vinyl chloride and Reformat Release Area included in 2020 study area above.	Sparge systems will be operated to prevent off-site migration of groundwater and COIs.
COI in Soil	Site-wide soils including AOCs and SWMUs.	CMI – Ongoing	Reformat Release Area included in 2020 study area above.	Product removal will be conducted in wells with measurable NAPL to the extent practical. Monitoring will be conducted to evaluate permit compliance, corrective action performance, MNA and plume characteristics.
Product on Groundwater	LNAPL on groundwater	CMI – Ongoing	No change	

Table Acronyms

AOC = Area of Concern

BTEX = benzene, toluene, ethylbenzene, xylenes

CMA = Corrective Measures Alternative

CMI = Corrective Measures Implementation

COI = constituent of interest

CVOC = chlorinated volatile organic compound

DNAPL = dense non-aqueous phase liquid

IM = Interim Measures

LNAPL = light non-aqueous phase liquid

MNA = monitored natural attenuation

NAPL = non-aqueous phase liquid

NFA = No Further Action

SMWU = Solid Waste Management Unit

SVOC = semi-volatile organic compound

TCE = trichloroethylene

VC = vinyl chloride

VOC = volatile organic compound









